AGGREGATES in NOVA SCOTIA

by

G. Prime

INFORMATION CIRCULAR

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Cover Photo: Aggregate quarry, Sheet Harbour, Halifax County.

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of Mines and Energy
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AGGREGATE

Introduction

Aggregate may be defined as any of several hard, inert materials, such as sand, gravel, slag or crushed stone used for mixing with a cementing or bituminous material to form concrete, mortar, or plaster, or used alone as in railroad ballast or grading fill. It is a fundamental building material widely used in our industrial society.

The aggregate industry in Nova Scotia has a history dating back several hundred years and has evolved into an important economic base in the Province today. In recent years production has been in the range of 12 million t (Fig. 1), with a product value of approximately $55 million and employing more than 700 people. Although it is primarily an industry associated with populous areas, its effects are felt throughout the Province. Throughout the production history, adequate indigenous resources have provided all of the aggregate materials required to meet Provincial needs and supply continuously increasing volumes to export market.

The prosperity and growth of the aggregate industry has not been without problems. Intense extraction from the better quality deposits has resulted in a severe depletion of the resource in some areas. Competition for land use involving

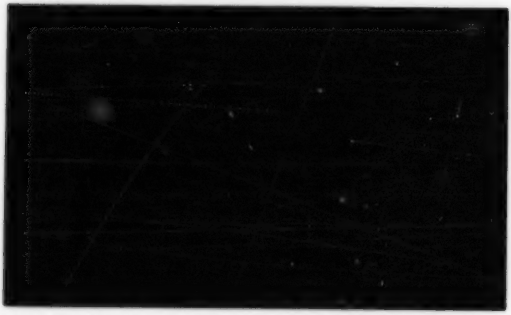


Figure 1. Annual aggregate production for Nova Scotia.

such interests as agriculture, recreation, and urban growth has often resulted in the loss of resource land. Environmental concerns are also being strongly expressed, the consequence being sterilization of many quality deposits. In spite of a thriving industry, there is justified concern for the future of aggregate mining in the Province.

HISTORICAL BACKGROUND

Nova Scotia is a coastal Province with numerous bays, inlets, and near shore islands where sand and gravel beaches are plentiful. Early settlers to the coastal region used beach sand and gravel to satisfy their aggregate needs.

It soon became apparent that some beaches were capable of providing large quantities of superior quality sand and gravel and that a market existed in larger centres. Many of the islands in Mahone Bay were well known for their excellent beach sand deposits, and, in the middle to latter part of the last century, a flourishing sand trade developed between the Mahone Bay islands and the City of Halifax. Sand was loaded on schooners by hand and shipped to Halifax to make concrete used in many early structures, including the first dry dock at the Halifax shipyard which opened in 1889. This dry dock is still in use today.

In Halifax Harbour, sand and gravel dredging around McNabs Island continued until the mid 1970s. At the height of activity, as many as seven operations produced up to 900 t per day, all for the Halifax-Dartmouth market. These operations consisted of cranes equipped with clams for loading scows which were pulled by tugs to Halifax and Dartmouth.

By the 1960s, opposition to beach mining had increased to the point that the Provincial Government took action either to forbid or control sand and gravel extraction from beaches. In 1975, the Beaches Preservation and Protection Act was proclaimed which effectively halted beach mining. As a result serious concerns were expressed on the part of the supply companies. It was strongly suggested that closing the beaches would create aggregate shortages and would even put some operations out of business.

The transition to land based aggregate sources which followed was made easier for the

producers through the efforts of the Nova Scotia Department of Mines, which conducted a Province wide inventory of sand and gravel deposits. A subsequent depletion of the better quality surficial materials has occurred, the result being that there is a progressive increase in the amount of bedrock quarried and processed in the Province for aggregate purposes. To demonstrate this shift, quarried stone represented 13 per cent of the total aggregate production in 1970, 17 per cent in 1980, and 41 per cent in 1986. Accompanying this shift is the development of a strong aggregate export market supplying several centres on the east coast of North America. Most recently an interest in offshore marine aggregate has developed, based on the knowledge that there are extensive sand and gravel deposits on the Scotian Shelf. Although this facet of the resource is not currently being mined, there is abundant potential for the future.

AGGREGATE SOURCES

There are two basic sources of aggregate, granular materials and crushed stone.

GRANULAR AGGREGATE

Granular aggregate occurs as sand and gravel in unconsolidated surficial deposits. Nova Scotia has an abundance of sand and gravel spread throughout the Province, as indicated in Figure 2. Included in this group are ice contact deposits, proglacial deposits, modern stream alluvium, glacial

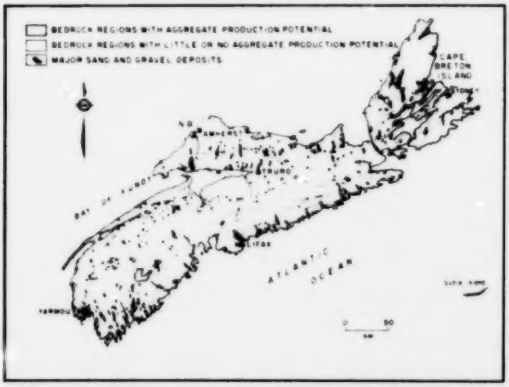

BEDROCK REGIONS WITH AGGREGATE PRODUCTION POTENTIAL
BEDROCK REGIONS WITH LITTLE OR NO AGGREGATE PRODUCTION POTENTIAL
MAJOR SAND AND GRAVEL DEPOSITS
CAPE BRETON ISLAND
ATLANTIC OCEAN

Figure 2. Major sand and gravel deposits in Nova Scotia.

tills, weathered bedrock, and marine deposits. The ice contact and proglacial deposits are used extensively as aggregate whereas other materials remain minor contributors to the aggregate budget in the Province. The quality of granular deposits ranges from unacceptable to excellent.

(1) **Ice contact deposits** occurred as meltwater channel sediments on, in, or under the glacial ice mass. When the ice melted, the deposits were dumped onto the landscape in the form of mounds. They include eskers, kames, and kame terraces. These deposits are abundant and used extensively throughout the Province.

(2) **Proglacial deposits** occurred at the front of the ice mass in shallow, fast flowing meltwater streams. The deposits which formed are flat lying, well-sorted, and of substantial thickness. Where the streams flowed into lakes or marine water, coarse deltaic deposits developed. The deposits are usually well sorted and make good quality aggregate.

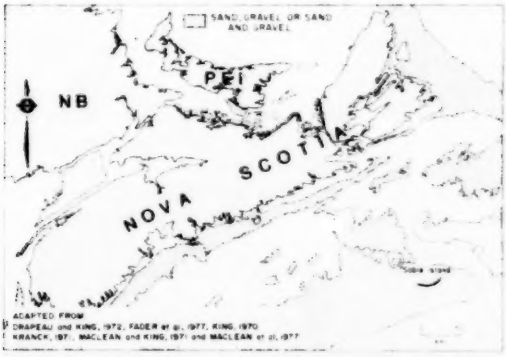
(3) **Modern stream alluvium** is a product of recent stream deposition and consists of both sand and gravel. The deposits are relatively confined in both volume and areal extent. Although the quality of the deposits may be excellent, their location close to streams and rivers often makes the deposits inaccessible for environmental reasons.

(4) **Glacial tills** or moraines are deposited as ice transported materials which are carried along beneath or in the ice mass. In general these materials are poorly-sorted and used as fill, however, some of the deposits are capable of producing high-quality materials.

(5) **Weathered bedrock** occurs as a residuum at the surface of bedrock where conditions permit. Rock types such as conglomerate and granite, which are subjected to chemical and mechanical breakdown, can produce an upper zone of gravel like materials. In many regions, such as Cumberland County, these deposits are quite extensive and up to 6 m in thickness. At present they are used primarily for fill and the building of haulage roads.

(6) **Marine deposits** in Nova Scotia include both beach deposits and offshore, continental shelf deposits. Extraction of beach materials is generally prohibited in accordance with the Beaches Preservation and Protection Act of 1975, however, small amounts of sand are still extracted under

special license in one area on Cape Breton Island. Extensive, untapped sand and gravel deposits have been mapped offshore Nova Scotia with large portions of these deposits occurring in water depths that would permit mining with established dredging technology. These deposits were formed by reworking processes, including high energy wave action on earlier glacial deposits in a transgressing marine environment. These processes served to clean and sort the tills and destroy soft, deleterious materials, leaving clean sand and gravel deposits ranging in thickness from less than 1 m to 50 m. The distribution of offshore sand and gravels beyond the shallow coastal water zones is shown in Figure 3.


SAND, GRAVEL OR SAND AND GRAVEL
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ADAPTED FROM
DRAPEAU and KING, 1972, FADER et al., 1977, KING, 1970
KRANCK, 1971, MACLEAN and KING, 1971 and MACLEAN et al., 1977

Figure 3. Distribution of offshore sand and gravel deposits (adapted from Drapeau and King, 1972; Fader et al., 1977; King, 1970; Kranck, 1971; MacLean and King, 1971; and MacLean et al., 1977).

CRUSHED STONE

Certain areas of the Province no longer have adequate supplies of granular aggregate, relying upon quarried bedrock to meet their needs. The result is that the annual production of bedrock materials has increased dramatically in recent years (Fig. 4).

Crushed stone consists of consolidated bedrock which has been quarried, crushed, washed, and sized for the purpose of producing quality aggregate. Rock types in the Province suitable for the production of crushed stone are unevenly distributed (Fig. 2). In general the bulk of crushed aggregate comes from metasedimentary

rocks, granites, and volcanic rocks. Areas underlain by Late Devonian or younger sedimentary rocks are generally unacceptable for the production of high quality materials.

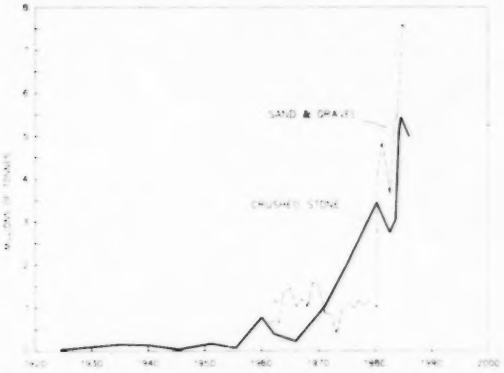

Figure 4. Annual production of granular aggregate and crushed stone in Nova Scotia.

USES

Aggregate materials have many applications, however, their primary use is in the construction industry. The most important use in Nova Scotia is in the construction of roads and highways, the major consumer being the Nova Scotia Department of Transportation and Communications. Building construction is also important. This includes a variety of concrete products such as foundations, concrete blocks, concrete panels, pipes, and other structural products.

There are many other aggregate products including road metal, railroad ballast, mortar mix, auto traction sand, abrasives, roofing gravel, silica sand in the production of glass, poultry grit, blasting grit, fracturing sand to enhance oil and gas production in petroleum wells, filter sands for water supply systems, rip rap for breakwater construction and shoreline stabilization, and gabion stone for retaining walls.

MARKET AND TRANSPORTATION

Most of the aggregate produced in Nova Scotia is consumed here, with less than 10 per

cent of total production leaving the Province as export. Figure 5 shows the transportation pattern for aggregates produced in Nova Scotia, both for local and export markets. Within the Province, all shipments are moved by truck, while shipments to markets in New Brunswick, Prince Edward Island, and Quebec are by truck, rail, and barge. Shipments to the southern United States are moved in modern, self unloading vessels.

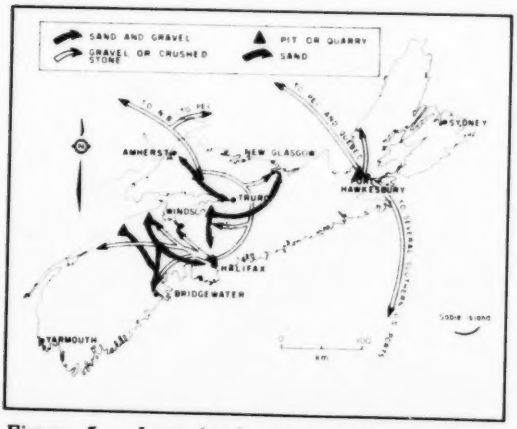

Figure 5. Long haul aggregate transportation patterns in Nova Scotia.

The majority of Nova Scotia aggregate is consumed in our cities and large towns. Figure 6 shows where the major consumption centres are located. Halifax-Dartmouth consumes over 3 million t annually and is the Province's major aggregate consuming centre, followed by Sydney. These materials are used for street and road construction, sewage projects, commercial site preparation, parking lots, residential uses including foundation preparation and drainage, and backfill.

PRODUCERS

Figure 6 shows high production regions in Nova Scotia. Two companies ship significant volumes out of the Province. One producer at Folly Lake, Cumberland County, ships crushed rock railway ballast as far as southeastern Quebec and granular aggregate materials to Prince Edward Island. Most shipments are by rail. At Auld Cove, Guysborough County, on the Strait of Canso, another

producer ships crushed rock to Prince Edward Island by barge and uses self unloading vessels to move shipments to the eastern seaboard of the United States.

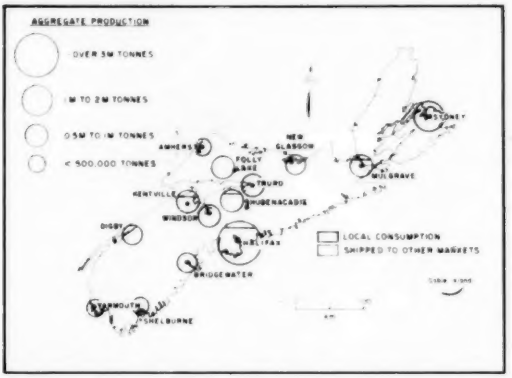

Figure 6. Major aggregate production and consumption centres in Nova Scotia.

Aggregate production in the Halifax-Dartmouth region comes from five quarries rimming the metropolitan area. Quarry output ranges from a low of 60 000 t to a high of 1.3 million t. All concrete, mortar, and some asphalt sand is trucked from Shubenacadie (65 km north of Halifax) and Coldbrook (115 km west of Halifax).

In Sydney, most of the aggregate production comes from the Meadows Road sand and gravel deposits, 15 km southwest of Sydney, and a quarry at Leitches Creek, 25 km northwest of Sydney. Recently, new deposits of surficial and bedrock aggregates have been identified and production started.

In most other regions of the Province, local sand and gravel deposits provide the bulk of aggregate materials. However, new quarries are being developed in regions where these deposits are scarce or unacceptable for concrete or asphalt production.

EXPORT MARKET

Recent years have seen a substantial aggregate export market develop in the Province. In 1986 production of crushed stone from Nova Scotia quarries was 4.9 million t of which 20 per cent

was exported. This exported stone was produced by Construction Aggregates Limited at their Auld Cove, Guysborough County quarry. Construction Aggregates Limited established this quarry in 1978 and produces about 1 million t of aggregate annually. Over 90 per cent of their production is exported and shipped by bulk ocean carrier to destinations such as Bermuda and several ports in the United States including Savannah, New Orleans and Huston. Major reasons for this success are the tidewater location of the operation and the fact that bulk shipping is a very cost effective method for transporting the materials.

Consumption of aggregate is steadily increasing in the United States and this trend should continue. Nova Scotia is ideally situated to take advantage of this market. The Nova Scotia Department of Mines and Energy conducted a study to determine the potential of developing additional aggregate quarries on tidewater in the Province (Dickie, 1987). Site selections of potential deposits were based on rock types, topography, tidewater depth, and property ownership. Results of the investigation indicate that five locations contain deposits of aggregate quality rock suitable for the export market. Figure 7 illustrates these sites which include Kellys Cove, White Point, Sheet Harbour, Flagstaff Hill, and Terence Bay.

Figure 7. Location of potential crushed stone deposits on tidewater in Nova Scotia.

MINERAL RIGHTS STATUS

Under the current Mineral Resources Act, sand, gravel, and stone are not Crown Minerals. In order to open and operate a sand/gravel pit or a crushed rock quarry, the surface rights for the property must be held by the owner/operator of the quarry or arrangements must be made with the land owner to develop the quarry. Permission to establish an operation must be obtained from the Nova Scotia Department of the Environment. Regulation of health and safety procedures in an operating pit or quarry is the responsibility of the Nova Scotia Department of Labour.

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